BTEC Assignment Brief

Qualification	Pearson BTEC International Level 3 National Diploma in Civil Engineering Pearson BTEC International Level 3 National Extended Diploma in Civil Engineering
Unit number and title	Unit 6: Construction Mathematics
Learning aim(s)	A: Understand basic underpinning mathematical techniques and methods to manipulate and/or solve formulae, equations and algebraic expressions B: Examine and apply mathematical techniques correctly to solve practical construction problems involving perimeters, areas and volumes
Assignment title	**Solving construction problems**
Assessor	
Issue date	
Hand in deadline	

Vocational Scenario or Context	You have been employed as a trainee engineer in the design office of a large Engineering Design Consultancy practice. You will be working in the quantity surveying section who specialise in measuring and costing various elements of work. This can include area and volume calculations, quantity of materials to be ordered, setting out dimensions and angles may also be needed for contractors. It is vital that you can demonstrate your understanding of the mathematical methods and techniques required for these key activities.
Task 1	You have been set some initial calculations to ensure you understand and can apply basic functions of a calculator. Part A a) Use an electronic calculator to solve the following calculations. Express your answers to three significant figures. Where applicable use the correct units. (i) 26.67 m/s × 43 s (ii) 17.9 KN ÷ 7.11 m^2 (iii) √(465 × 0.7) (iv) 12.7 sin 45º (v) Cos 60º ÷ 3 b) Use an electronic calculator to solve the following calculations. Express your answers to three decimal figures. Where applicable use the correct units. (i) 6 ÷ tan 30º (ii) 3.4^3 (iii) $\sqrt[3]{64}$ m^3

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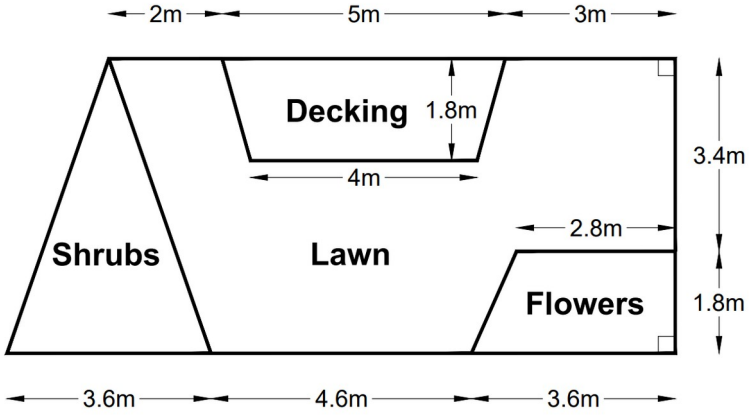
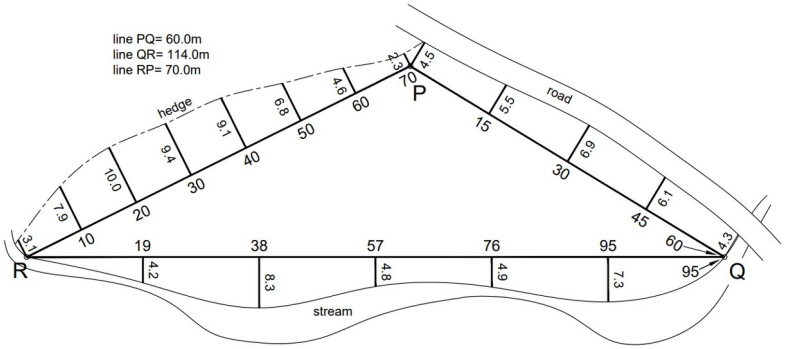
	(iv) 9 $\log_{10} 2.5$ (v) $10^{2.17}$ c) Convert these numbers into the standard form (i) 39800000000 (ii) 1567000 (iii) 0.000037686 (iv) 0.0000000002234 (v) 76543200000000 d) Covert these into real numbers (i) 11.32×10^{3} (ii) 4.15×10^{2} (iii) 6.11×10^{-1} (iv) 3.6223×10^{-5} (v) 8.4321×10^{-4}
Task 2	Expand, simplify and evaluate the following equations for x = 4 (x can be varied for each student) a) i) 8x + 3(x +7) ii) 4(x + 7) + (x- 4) iii) 6(9x + 3) - 8(x -2) – 5(6x -3) b) Transpose the following equations to make y the subject i) 3x + 8 = 5 – 2y ii) 6(6 – 4y) + 5(6y + 3) = 4x + 9 iii) $\frac{3x}{6}+4=\frac{3y}{4}-6$
Task 3	a) Solve these simultaneous equations using substitution and/or elimination. i) 2a + 3b = 15 and a +2b = 8 ii) 3g + 4h = -29 and 4g -3h = 3 iii) 7m – 3n = 20 and 3m – 5n = 3 b) You have received two invoices for bricks and concrete blocks purchased from a local supplier. The first invoice is for 1000 bricks and 3000 concrete blocks at a total cost of

	£3100. The second invoice is for 4000 bricks and 2000 concrete blocks at a total cost of £4400. Both invoices are exclusive of VAT. Assuming that the price of the bricks and concrete blocks has not changed between the two invoices, use a *graphical* method to determine the total cost of 1000 bricks and 1000 blocks. Using an alternative method solve the equations showing all steps in the method. c) Solve these quadratic equations using either factorisation or the quadratic formula as appropriate. Substitute your answers in the equations to check your solutions i) $x^2 - x - 2 = 0$ ii) $x^2 + 2x - 3 = 0$ iii) $3x^2 + 4x - 1 = 0$ iv) $5x^2 + 24x = 5$ d) You are working with a structural engineer who informs you that the point of contraflexure on a beam can be found by solving a quadratic equation. This is important because it tells us where the position of the reinforcement must change from the bottom of the beam to the top. The quadratic equation that applies in this case is: $5x^2 + 6x - 4 = 0$ Use a graphical method to determine x (the distance of the point of contraflexure from the end of the beam). Identify any other method that could be used to determine the answer and use this method to perform a check. Present your answers to a sensible degree of accuracy.
Task 4	A landscape architect in the company has asked you as a trainee surveyor to carry out some calculations. A side garden for a new house is to be laid out as shown in the diagram below. 

	Calculate the area of the lawn. If topsoil is to be placed over the whole garden (including Shrub and flower beds but not decking area) at a depth of 250mm, calculate the volume of topsoil which is needed for the garden A timber edge is to be placed around the lawn. Calculate the length of timber required for the edging around the lawn allowing 4 for wastage.
Task 5	A Surveyor within the company has asked you to calculate the area of a parcel of land for a client. Land surveyors have carried out a chain survey of a site bounded by hedge adjacent to the survey line RP, by a roadway adjacent to the survey line PQ and a stream adjacent to survey line RQ. Calculate the area of the site bounded by the hedge; road and stream. Calculate the volume of topsoil to be removed assuming that it is 55mm thick. Calculate the length of the hedge. 
Task 6	A Civil Engineer in your company is calculating the flow of a storm culvert for a drainage programme. To help her she has asked you to calculate the hydraulic mean radius (m) of the pipe. The first step is to calculate the wetted perimeter (**p**) for the pipe whose diameter is 1.5m and is filled with water 1.0m deep. The second step is to calculate the cross-sectional area (**A**) of the water in the pipe. Using your values for **p** and **a** calculate **(m)** the hydraulic mean radius. $m = \frac{\text{cross-section area of flow } \mathbf{A} \text{ } (m^2)}{\text{wetted perimeter } \mathbf{p} \text{ } (m)}$

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	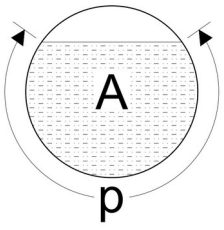
Checklist of evidence required	A well-presented report with calculations, drawings, units and alternative mathematical methods to check solutions were appropriate. Clear conclusions should be drawn on the outcomes for the industrial related situations.

Criteria covered by this task:	
Unit/Criteria reference	To achieve the criteria you must show that you are able to:
6/AB.D1	Independently carry out checks on calculations using relevant alternative mathematical methods, making appropriate judgements on the outcome.
6/A.M1	Demonstrate the use of algebraic methods to solve linear, quadratic and simultaneous linear and quadratic equations.
6/B.M2	2 Demonstrate the use of appropriate algebraic methods to find lengths, angles, areas and volumes for one 2D complex construction industry-related problem.
6/A.P1	Demonstrate the use of the main functions of a scientific calculator to perform calculations, applying manual checks to results.
6/A.P2	Demonstrate the use of standard mathematical outcome techniques to simplify expressions and solve problems using linear formulae
6/A.P3	Demonstrate the use of graphical methods to solve linear and quadratic equations
6/B.P4	Demonstrate the use of mathematical techniques to solve construction problems associated with simple perimeters, areas and volume.

Sources of information to support you with this Assignment	“Construction Maths: Advanced” by Robert Beslen (ISBN 9780340662373)
Other assessment materials attached to this Assignment Brief	

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